

## CURRENT RESOURCE PORTFOLIO

City Light uses a combination of energy efficiency and power resources to meet its customers' energy needs. The utility's current resource portfolio includes energy efficiency, owned generation resources and long-term contract resources, supplemented with power exchange agreements and near-term purchases and sales made in the wholesale power market. City Light owns transmission facilities and depends primarily on the Bonneville Power Administration (BPA) for electric transmission outside its service area.

The following sections discuss existing energy efficiency, generation, and market resources City Light uses to meet its customers' need for energy services.

### ENERGY EFFICIENCY

Energy efficiency was introduced into City Light's resource mix over 30 years ago and has remained the utility's first choice resource for meeting load growth. The energy efficiency partnership between the utility and its customers has successfully deferred acquisition of expensive new resources, especially those that negatively affect the environment, while maintaining system reliability.

Energy efficiency programs encourage customers to use power more efficiently and allow the utility to defer the acquisition and expense of new resources. Energy efficiency is low cost and has low environmental impacts, including no greenhouse gas emissions. It is integral to developing City Light's Integrated Resource Plan (IRP), to maintaining its status as a greenhouse gas neutral utility, to supporting the City's climate change policy goals, and to meeting the renewable portfolio standard (RPS) requirements. It has also been good policy in a transforming energy market because it reduces price risk and availability risk.

Energy efficiency programs are designed for all customer classes and address specific energy end uses such as efficient lighting, water heaters, laundry appliances, HVAC (heating, ventilation and air conditioning), and motors and manufacturing equipment. They also encourage weatherization and high-efficiency construction methods. Monetary incentives to utility customers include rebates, loans, or outright purchase of savings for installed energy efficient measures.

Using information from City Light's most recent energy efficiency potential assessment, conducted in 2015, the 2016 IRP assumes there are at least approximately 25.62 aMW of cost-effective energy savings potential available in 2016-2017 and 128.1 aMW over the next 10 years of the planning horizon.

### ENERGY SAVED BY ENERGY EFFICIENCY PROGRAMS

City Light has one of the longest-running energy efficiency programs in the country. Since its start in 1977, energy efficiency measures supported by the utility have been installed in residential, commercial and industrial facilities throughout our service territory. As a result of this legacy and current energy efficiency programs, City Light's annual load is reduced by 1,560,594 megawatt-hours. That is enough electricity to power over 195,600 average Seattle homes – over one-third of our residential service.

In 2000, a home in our service territory used 10,300 kilowatt-hours of electricity per year, which was very close to the national average. Today, the average City Light residential customer uses approximately 7,975 kilowatt-hours—almost 3,000 kilowatt-hours less than the national average.<sup>1</sup>

Due to energy efficiency measures currently in place across our service territory, City Light avoided the annual release of more than 998,780 metric tons of carbon dioxide into the atmosphere in 2015. That is equivalent to 219,732 households driving one fewer car for a year.

## GENERATION RESOURCES

Over 90 percent of City Light's power is generated by hydropower, including its own low-cost hydroelectric facilities in Washington State. As a municipal utility, City Light enjoys preferential status in contracting for the purchase of additional low-cost power that BPA markets. The utility has contracts with several other owners of hydroelectric projects in the region. In 2002, City Light signed a 20-year contract with the Stateline Wind Project; in 2007, City Light began purchasing power from a biomass plant owned by Sierra Pacific Industries in Burlington. In November 2012, City Light has contracted an additional 6.4 MW with Waste Management Renewable (WMRE), because of the expanded capacity of the Columbia Ridge facility. City Light has contracted with King County for output from a cogeneration plant at the West Point Treatment Plant in Discovery Park.

The West Point Treatment plant is within City Light's service area. Its other resources and their locations are shown on the map in Figure 1. See Figure 3, following the descriptions of City Light resources, for the amounts generated by City Light resources over the period 1999-2014.

**Figure 1: City Light's Generation Resources**



## City Light Resources

Boundary Dam is City Light's largest resource with a peaking capability of 1,055 MW and average generation of about 438 MW annually. Under the Federal Energy Regulatory Commission (FERC) license, part of Boundary output must be sold to Pend Oreille County Public Utility District No. 1 to meet the PUD's load growth. In addition, about five aMW of energy must be delivered to the PUD in compensation for Boundary Project's encroachment on its Box Canyon Dam. Energy from Boundary is delivered to consumers over BPA's transmission grid.

Skagit Project includes the Ross, Diablo, Gorge and Newhalem projects, which have a combined one-hour peak capability of 692 MW at full pool. City Light's transmission lines carry the power generated from the Skagit Project to Seattle.

South Fork Tolt has a one-hour peaking capability of less than 17 MW. Project costs are offset by BPA billing credits. Power from this project is delivered over a line owned by Puget Sound Energy.

Cedar Falls Dam has capacity of 30 MW. Power is transmitted by Puget Sound Energy.

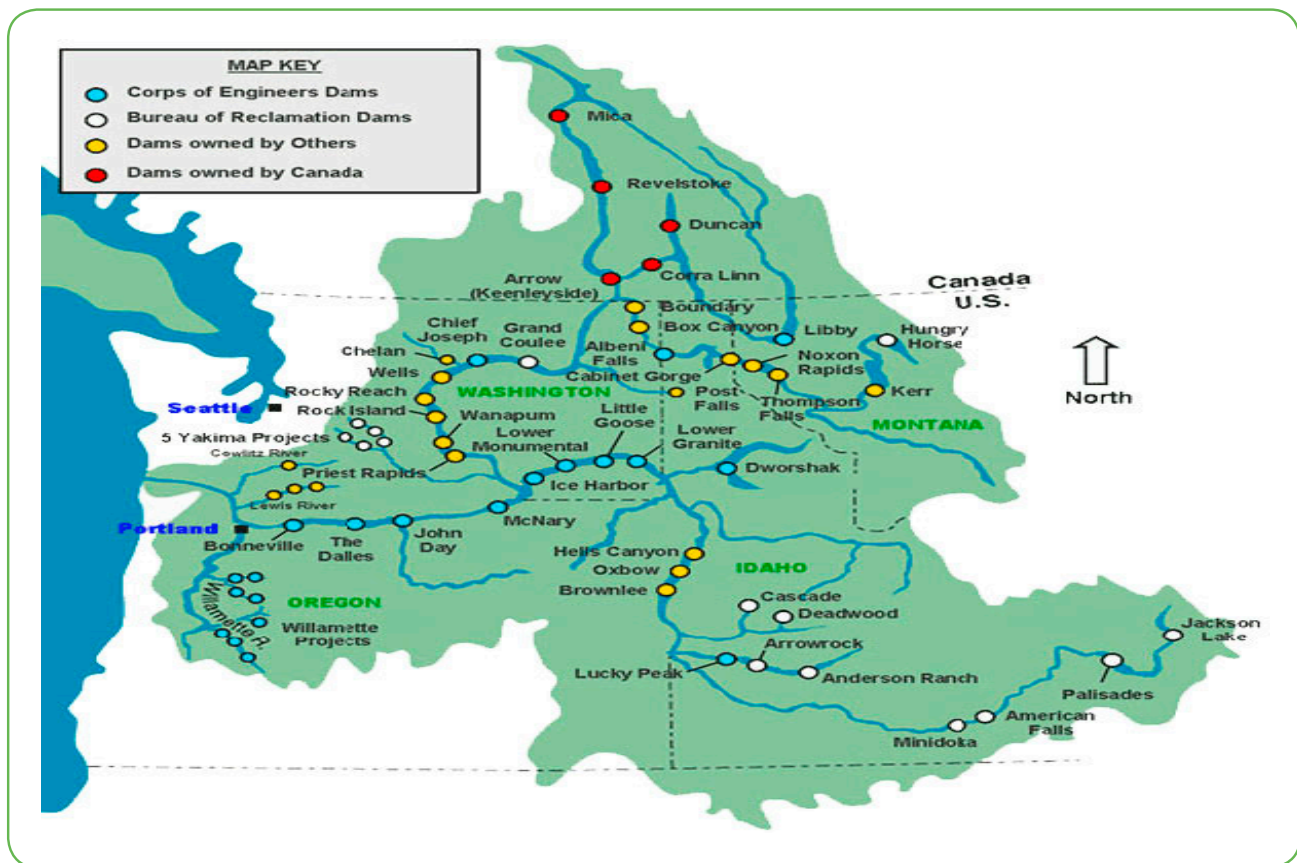
## Contracted Resources

### Bonneville Power Administration

City Light's largest power purchase contract is with BPA. The contract allows the utility to receive power from 31 hydroelectric projects and several thermal and renewable projects in the Pacific Northwest. Energy is delivered over BPA's transmission grid. In December 2008, City Light signed a contract with BPA to continue City Light's access to the power resources that BPA markets through September 2028. Figure 3 identifies the hydro generation resources in the Pacific Northwest. City Light receives from BPA a share of the hydroelectric generation identified by Corps of Engineers dams and Bureau of Reclamation dams in the map.

Under the BPA contract, power is delivered in two forms: a shaped block and a slice. Through the block product, power is delivered in monthly amounts shaped to City Light's monthly net requirement, defined as the difference between City Light's projected monthly load and the resources available to serve that load under critical water conditions. Under the slice product, City Light receives a fixed percentage of the actual output of the federal system and pays the same percentage of the actual costs of the system. Power available under the slice product varies with water conditions, federal generating capabilities, and requirements for fish and wildlife protection and restoration.

**Figure 2: Hydro Generation Resources Pacific Northwest**



### High Ross Agreement

In an 80-year treaty with the Canadian Province of British Columbia, City Light abandoned plans to raise the height of Ross Dam in exchange for power purchases from British Columbia Hydro (acting through its subsidiary PowerEx). Power delivery and price are similar to the generation and costs City Light would have experienced had construction taken place. Through 2020, the power City Light receives from the contract has a relatively high cost. In 2021, the price reduces to about a dollar per MWh because the cost portion, equivalent to debt service that would have been issued to build the High Ross Dam, will terminate. PowerEx delivers the power to City Light over its and BPA-owned transmission lines.

### Lucky Peak

Because of its location near Boise, Idaho, Lucky Peak can sell power to all major western trading hubs (Mid-C, COB, PV, Mead, and Four Corners) without encountering normal transmission constraints. City Light has the option to sell to the highest price market. City Light has contract rights to Lucky Peak output (approximately 34 aMW annually) until 2038.

### **Priest Rapids Project**

The Priest Rapids Project consists of two dams: the Priest Rapids Dam and Wanapum Dam. City Light purchases power from this project under two agreements with Grant PUD, which owns and operates the project. The term of the agreements is to the end of the current federal license for the project, which is April 2052. Seventy percent of Priest Rapids Project's output has been allocated to Grant PUD. Under one agreement, City Light purchases about two to three average megawatts of output at the production cost of the facility. Under the second agreement, City Light has the option to receive a share of proceeds, if any, from an auction of 30 percent of the output, or to purchase the share of the output at the price set in the auction. City Light uses BPA transmission to deliver the power.

### **Columbia Basin Hydro<sup>2</sup>**

City Light has contracts to buy half of the output, or about 27 aMW, from five Columbia River Basin hydroelectric projects. City Light's contracts expire over the period 2022-2027. The projects are part of three irrigation districts, so electric generation is mainly in the summer months. BPA and local agencies transmit the power to Seattle.

### **Northern California Power Agency**

Under its exchange agreement with the Northern California Power Agency (NCPA), City Light delivers 60 MW of capacity and 90,580 MWh of energy to NCPA in the summer. In return, NCPA delivers 46 MW of capacity and 108,696 MWh of energy to City Light in the winter. Deliveries to NCPA started in 1995 and will expire in 2018.

### **Stateline Wind Project**

City Light has an agreement with Constellation Energy to purchase wind-generated electrical energy and associated environmental attributes from the Stateline Wind Project on the Washington and Oregon border outside Walla Walla, Washington. City Light receives wind energy at an aggregate maximum delivery rate of 175 MW per hour through December 2021. Energy delivered under the contract is expected to average about 45 aMW. City Light has also entered into an agreement through 2021 to purchase integration and exchange services from PacifiCorp. BPA and PacifiCorp provide transmission for delivery to City Light's service area.

### **Burlington Biomass Facility**

City Light has an 11-year power contract (2007-2017) with the Sacramento Municipal Utility District (SMUD) to deliver 15 MW of the output of a 23 MW capacity biomass generating plant (Sierra Pacific Industries' sawmill and co-generation plant in Burlington, Washington) to the California-Oregon border. City Light purchases energy and environmental attributes. The amount is expected to average about three aMW over the course of the year. Puget Sound Energy provides transmission from Burlington to Seattle; City Light uses BPA transmission to deliver the energy to California.

### **Columbia Ridge Landfill Gas Project**

City Light has a 20-year power purchase agreement with Waste Management Renewable Energy, LLC to purchase the output, approximately 12 aMW, from the Columbia Ridge Landfill Gas project in Arlington, Oregon. As organic materials decay in a landfill, a by-product is methane, which can be collected and burned to produce electricity. The plant began commercial operations in January 2010. The Columbia Basin Co-Op and BPA provide transmission.

### **King County Wastewater Treatment**

City Light has a 20-year power purchase agreement that began in February 2010 with King County to purchase the output from a cogeneration plant at the West Point Treatment Plant in Discovery Park. The expected output is 2.5 aMW. Methane is a by-product of the treatment process, and the methane will be collected and burned to produce electricity. The plant is inside City Light's service area so no transmission is required.

### **Power from Existing Generation Resources**

Figure 3 shows the recent history of annual power production from each of the generation resources described previously, as well as some no longer part of City Light's portfolio. The table demonstrates how the portfolio has changed in recent years and illustrates power production variability caused by weather. City Light's current generation resource portfolio is more than 90 percent hydro. Its hydro storage capability has the advantage of operational flexibility but the disadvantage of being significantly affected by weather conditions. The amount of water available for power generation is affected by the amount and the timing of precipitation, run-off from snow melt, and regulations governing the recreational use of lakes, irrigation, protection of fish habitat and other environmental concerns. Operational flexibility allows the utility to meet peak load easily most of the time, but the ability to serve year-round load can be greatly diminished when water levels are low.

Prior to 2006, the West experienced six consecutive years of drought conditions, with 2001 as the most severe. Water conditions in 2010 on the federal hydroelectric system are the fifth lowest since 1929. Thus, City Light's resource portfolio must be able to serve load under prolonged drought conditions that do occur in the region.

As shown in Figure 3, the amount of power produced from owned generation in 1999 was nearly twice the amount produced in 2001, illustrating the risks associated with hydropower production. To make up the shortfall in 2001, City Light increased its purchases from BPA, but was still forced to make purchases from the market. By 2002, City Light had signed a new contract with BPA that nearly doubled its purchases, which phased in through 2007. The current contract with BPA went into effect on October 1, 2011; it provides for nearly as much power as the previous contract with a larger share of block and smaller slice under low water conditions. Wind power from Stateline came online in 2002, and power from that source increased over the next two years to its current level.



**Figure 3: Power Generated  
Annually from Existing Resources  
in Average Megawatts**

OWNED GENERATION	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Boundary	508.1	431.7	267.1	452.2	408.1	398.8	395.1	493.1	414.6	435.1	410.3	359.1	513.6	432.9	395.6	485.2
Skagit – Gorge	135.4	109.3	70.4	117.0	106.3	105.2	88.7	99.6	122.9	104.4	95.9	99.5	124.9	123.1	109.0	120.8
Skagit – Diablo	116.7	92.7	54.5	102.8	84.9	88.5	74.8	85.1	95.3	86.1	78.9	82.2	105.1	106.7	94.5	97.9
Skagit – Ross	109.9	84.4	44.9	95.6	83.1	77.6	64.3	73.2	98.1	75.0	71.0	74.0	99.4	107.0	82.9	90.9
Skagit - Newhalem	-	0.4	1.1	1.1	0.9	1.4	0.7	1.0	0.6	0.2	0.3	0.5	0.2	-	-	-
South Fork Tolt	8.0	5.0	4.6	8.9	5.6	6.9	5.1	6.1	6.4	6.5	5.8	6.2	5.7	7.2	6.3	7.3
Cedar Falls	8.1	5.7	7.4	9.1	7.3	7.0	4.2	8.6	7.6	9.8	8.7	7.5	12.6	14.0	8.8	7.5
Centralia (sold 2000)	78.7	31.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total Owned Generation</b>	<b>964.9</b>	<b>760.7</b>	<b>450.0</b>	<b>786.7</b>	<b>696.2</b>	<b>685.4</b>	<b>632.9</b>	<b>766.7</b>	<b>745.5</b>	<b>717.1</b>	<b>670.9</b>	<b>629.0</b>	<b>861.5</b>	<b>790.9</b>	<b>697.4</b>	<b>809.5</b>
PURCHASE CONTRACTS	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bonneville Power Administration	180.6	193.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bonneville Power Administration Block	-	-	200.7	152.3	147.1	137.8	109.4	174.4	242.2	239.0	237.6	237.3	247.6	269.8	270.0	266.5
Bonneville Power Administration Slice	-	-	71.5	322.4	390.9	392.8	385.1	451.1	411.3	412.1	379.4	361.1	361.9	371.6	309.9	322.0
High Ross (B.C. Hydro)	35.2	33.8	35.1	33.9	36.0	34.8	35.4	36.1	35.8	35.3	35.7	35.1	35.8	35.1	35.7	35.1
Boundary Encroachment (BC Hydro)	1.7	2.0	0.9	1.2	1.6	1.5	1.7	2.6	1.9	1.9	1.7	1.8	2.0	1.4	1.2	1.5
Lucky Peak	48.6	38.8	21.5	33.0	33.4	31.3	25.8	46.5	31.2	35.4	36.9	32.6	44.4	45.7	24.6	35.2
Priest Rapids (Grant County PUD)	47.1	41.4	29.9	37.3	35.5	36.0	32.9	2.8	2.9	2.6	3.8	19.2	3.7	4.1	3.8	2.5
Columbia Basin (formerly GCPHA)	28.6	27.2	30.9	28.3	26.9	28.9	28.5	27.6	29.1	29.6	29.7	27.5	27.1	29.1	29.1	31.1
Stateline Wind	-	-	-	12.2	24.7	39.7	37.4	43.9	44.0	49.2	40.2	39.8	47.2	41.6	41.4	40.8
Klamath Falls (expired 2006)	-	-	37.2	81.0	74.7	81.8	66.4	11.4	-	-	-	-	-	-	-	-
Pend Oreille PUD (expired 2005)	8.1	6.6	4.9	5.0	5.4	6.7	3.0	-	-	-	-	-	-	-	-	-
Columbia Storage Power Exchange (expired 2003)	16.1	12.1	11.6	11.3	3.0	-	-	-	-	-	-	-	-	-	-	-
Columbia Ridge	-	-	-	-	-	-	-	-	-	-	0.2	5.8	5.7	5.7	5.9	7.9
<b>Total Purchase Contracts</b>	<b>366.0</b>	<b>355.6</b>	<b>444.2</b>	<b>717.9</b>	<b>779.2</b>	<b>791.3</b>	<b>725.6</b>	<b>796.4</b>	<b>798.4</b>	<b>805.1</b>	<b>765.2</b>	<b>760.2</b>	<b>775.4</b>	<b>804.1</b>	<b>721.6</b>	<b>742.7</b>

## FUTURE OUTLOOK FOR CURRENT GENERATION RESOURCES

Over the next 20 years, not all of the generation resources described above will remain as they are in the existing portfolio. Some contracts will expire or be modified over the planning period.

Recently, City Light's license to operate Boundary Dam has been renewed by Federal Regulatory Commission (FERC) until 2055. The Skagit Project license expires in 2024, and under FERC's current rules, City Light will begin the relicense process at least five years before license expiration.

The Stateline wind contract that provides for about 45 aMW expires in December 2021. Part of City Light's share of Priest Rapids generation is fixed; part of the share of output gradually declines over the 20-year planning horizon at the rate of Grant County PUD's load growth. City Light's contracts with the Grand Coulee Project Hydroelectric Authority begin to expire in 2022.

In December 2008, City Light and BPA executed a contract for the period 2011 to 2028. The contract continues City Light's purchase of the block and slice products. BPA will offer a two tier pricing system. The price of Tier 1 power is based on the cost of the existing federal base system resources. City Light has secured approximately 532 aMW, under critical water, of Tier 1 power, subject to an annual true-up. The price of Tier 2 power will be based upon the actual price of new resources. Presently, City Light has no plans to purchase Tier 2 power.

In the future, the resource portfolio will include more renewable resources, consistent with policy direction from the City Council to meet load growth with energy efficiency and renewable resources to the extent possible, and mitigate for any greenhouse gas emissions associated with meeting new load (Resolution 30144) and RPS requirements. The high achievement energy efficiency resource will also have a substantial impact as City Light continues to fund programmatic energy efficiency.

## MARKET RESOURCES

The wholesale electric power market in western North America plays an important role in meeting Seattle's power needs by allowing City Light to balance energy surpluses and shortages. Surplus power can be sold and power shortages can be made up with purchases both seasonally and over a period of years. Power can also be obtained from the wholesale market through seasonal capacity contracts, although City Light currently has no such contracts. In order to ensure winter reliability, the Resource Adequacy analysis for the 2016 IRP assumes that a maximum of 200 aMW of energy is available to City Light for purchase in the wholesale power market to meet short-term winter needs. Any needs above 200 aMW in the plan must be met by new energy efficiency and new firm resources.

With colder winter temperatures driving Seattle's power demand to peak in November through February and the spring snow melt driving hydropower production to peak in April to June, a seasonal mismatch exists between demand and supply of power. Keeping sufficient power generation capability to meet winter demand leads to excess generation capability the rest of the year. In addition to seasonal variation in supply and demand, precipitation may vary substantially from year to year, making it difficult to predict the supply of hydropower.

City Light actively manages its portfolio of power supply resources by purchasing and selling power in the wholesale markets and transacting seasonal exchanges of power. These transactions lower the rates charged to the utility's retail customers by generating revenues from sales of surplus energy and allowing purchases of lower cost power.

## WESTERN ELECTRIC TRANSMISSION SYSTEM

The western electric transmission system physically defines the wholesale market for electricity in western North America. This market is broadly made up of 11 western states, two Canadian provinces, and northern Baja California, Mexico, as shown in Figure 4.



Constructed primarily in the 1950s and 1960s, the high-voltage transmission system is owned by a number of both private and public utilities. In the Pacific Northwest, BPA operates about 75 percent of the transmission system, with other large transmission owner/operators, including PacifiCorp, Puget Sound Energy, Avista, Idaho Power, British Columbia Transmission Company, and Portland General Electric, operating the rest. The high voltage transmission system is near capacity in some parts of the West, including the Pacific Northwest.

Market transactions and seasonal exchanges are facilitated by City Light's ownership share of transmission capacity rights on the Third AC Intertie. This ownership share was acquired in 1994, when City Light signed an agreement with BPA for rights to 3.33 percent (up to 160 MW) of transmission capability over BPA's share of the Third AC Intertie. The Third AC Intertie is an alternating current (AC) line that connects the Northwest region with California and the Southwest.

**Figure 4: Western Electric Transmission System**



<sup>1</sup> <https://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3>

<sup>2</sup> Recently, Columbia Basin Hydro (CBH) changed its name from Grand Coulee Project Hydroelectric Authority.